

ZOOLOGISCHE MEDEDELINGEN

UITGEGEVEN DOOR HET

RIJKSMUSEUM VAN NATUURLIJKE HISTORIE TE LEIDEN
(MINISTERIE VAN WELZIJN, VOLKSGEZONDHEID EN CULTUUR)

Deel 60 no. 5

2 april 1986

ISSN 0024-0672

THE MORPHOLOGY OF *EPILOHMANNIA ZWARTI* SPEC. NOV., AN ORIBATID MITE FROM NEW GUINEA

by

L. VAN DER HAMMEN

Hammen, L. van der: The morphology of *Epilohmannia zwarti* spec. nov., an Oribatid mite from New Guinea.

Zool. Med. Leiden 60 (5), 2-iv-1986: 71-85, figs. 1-5. — ISSN 0024-0672.

Key words: Epilohmanniidae; morphology; mouthparts; New Guinea; Oribatida; Palpigradi.

A detailed description is given of a new species of the genus *Epilohmannia* Berlese (Oribatida) from New Guinea. The relationships of the species are discussed. The mouthparts, characterized by the fusion of the epimera of the segments of palp and leg I, are compared with those of the Palpigradi (in which group these epimera have also fused).

L. van der Hammen, Rijksmuseum van Natuurlijke Historie, P.O. Box 9517, 2300 RA Leiden, The Netherlands.

INTRODUCTION

Recently (Van der Hammen, 1985: 53; see also Van der Hammen, 1982: 34, fig. 15C), I suggested that a comparative study of the mouthparts of Epilohmanniidae and Palpigradi could be interesting because of the fusion, in both taxa, of the epimera of palp and leg I (a phenomenon not known from other Chelicerata). Because species of Epilohmanniidae are present among the material collected by me in New Guinea (see Van der Hammen, 1983), a detailed description is now prepared of one of the two species of the genus *Epilohmannia* Berlese in my material (it appeared to be undescribed). Both species have been collected by me at the same locality (Ajamaroe), but in different samples. The second species, not described here, belongs to a group of small, pale species related to *Epilohmannia pallida* Wallwork (1962). Species of *Epilohmannia* are apparently not common in New Guinea. The present paper contains a detailed description of the new species, and a discussion of its relationships. In a final paragraph the Epilohmanniid mouthparts are com-

pared with those of the Palpigradi. The present species is dedicated to my friend lieutenant-commander J. Zwart R. Neth. N., who accompanied me on many field-trips in New Guinea.

***Epilohmannia zwarti* spec. nov.**

(figs. 1-5)

Material. — Ajamaroe, Birdshead, former Netherlands New Guinea (now Indonesia), 25 February 1954, litter from humid part of forest in an area of limestone karst (sample M2). — 2♂, 2♀ (among which the male holotype, and the female allotype; the female paratype is represented by an idiosomatic exoskeleton only). Geographical and ecological data with reference to the type-locality, including a map and a photograph, are given in my paper on the soil-fauna of New Guinea (Van der Hammen, 1983: 8, 19-20, 35, fig. 1, p. 12).

Measurements. — Males: length 0.688-0.765 mm; breadth 0.376-0.417 mm; ratio length: breadth 1.83. Female: length 0.832 mm; breadth 0.454-0.457 mm; ratio length: breadth 1.82-1.83. Females are not only characterized by the larger size, but also by the relatively larger genital opening.

Colour. — The idiosoma is for the greater part dark chestnut-brown. The transparent rostral tectum and the legs are lighter brown. The dark colour of the idiosoma is partly caused by the contents of the body; in three of the four specimens its colour is of irregular intensity, whilst the female exoskeleton is lighter brown.

Tegument. — The surface of the cuticle is very glossy; there is no cerotegument. In most parts of the body, the superficial microsculpture consists of small, shallow, rather irregularly distributed pits. The microsculpture of epimera 2 is reticulate, with meshes broader than long; this reticulation is partly constituted by low, irregular, transverse ridges, of which the profile is particularly visible at the lateral border. In transparent light, the cuticle is characterized by a dense porosity, caused by the presence of numerous narrow canals in the cuticle (not in de epiostracum). In oblique view, the porosity has the appearance of an internal striation; in a view perpendicular to the surface, the porosity has the appearance of a punctuation. The punctuations are distinctly larger in the cuticle of the epimera and part of the prodorsum.

Prodorsum. — The prodorsal shield (fig. 1A, 2A) is laterally contiguous with the lateral region of the propodosoma. The posterior border of the prodorsum is connected with the notogaster by a disjugal area of soft skin, by which it can be retracted under the anterior notogastral border (fig. 2A). The anterior part of the prodorsal shield is constituted by a large rostral tectum

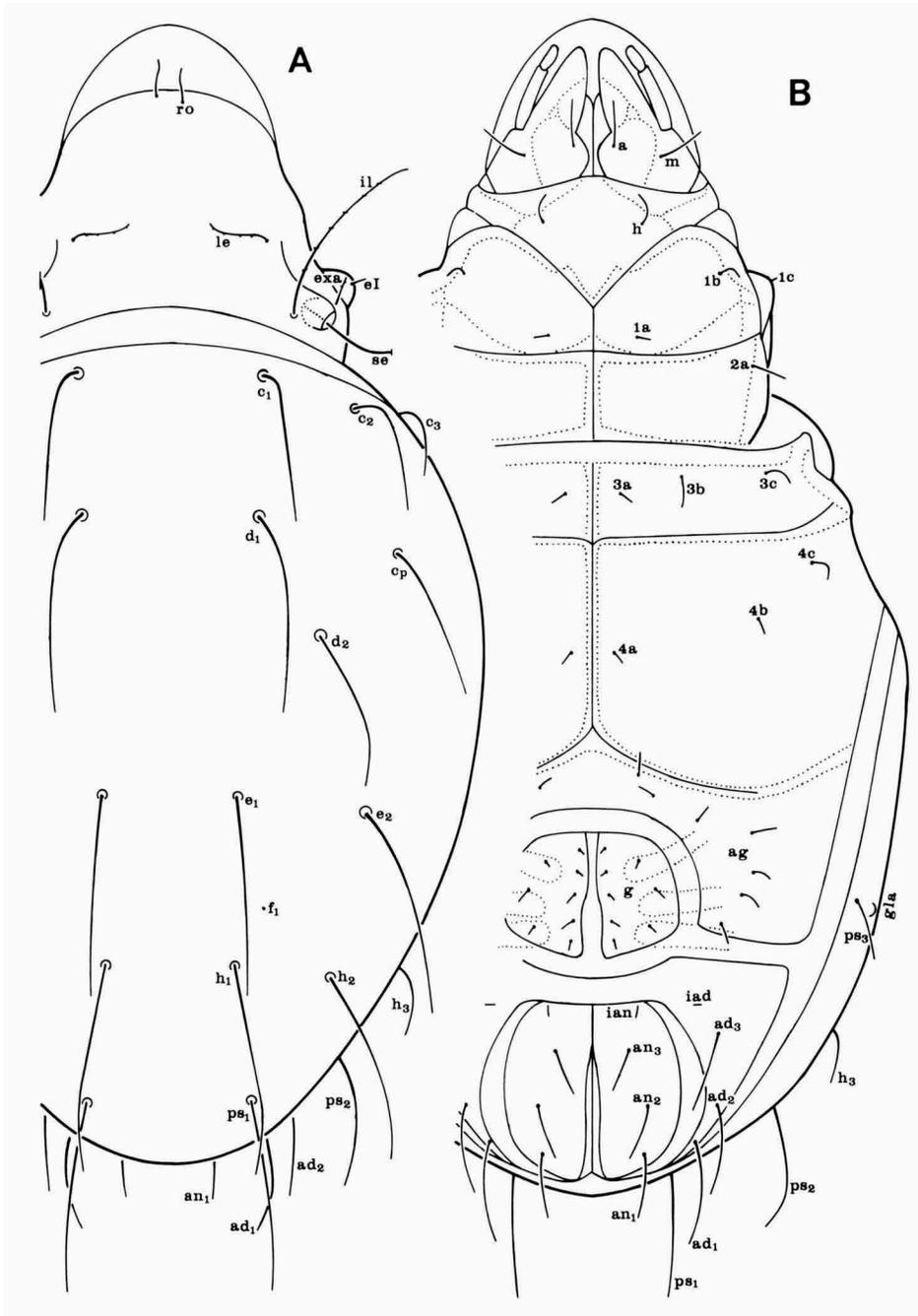


Fig. 1. *Epilohmannia zwarti* spec. nov., adult male; A, dorsal view; B, ventral view; A, B, $\times 200$.

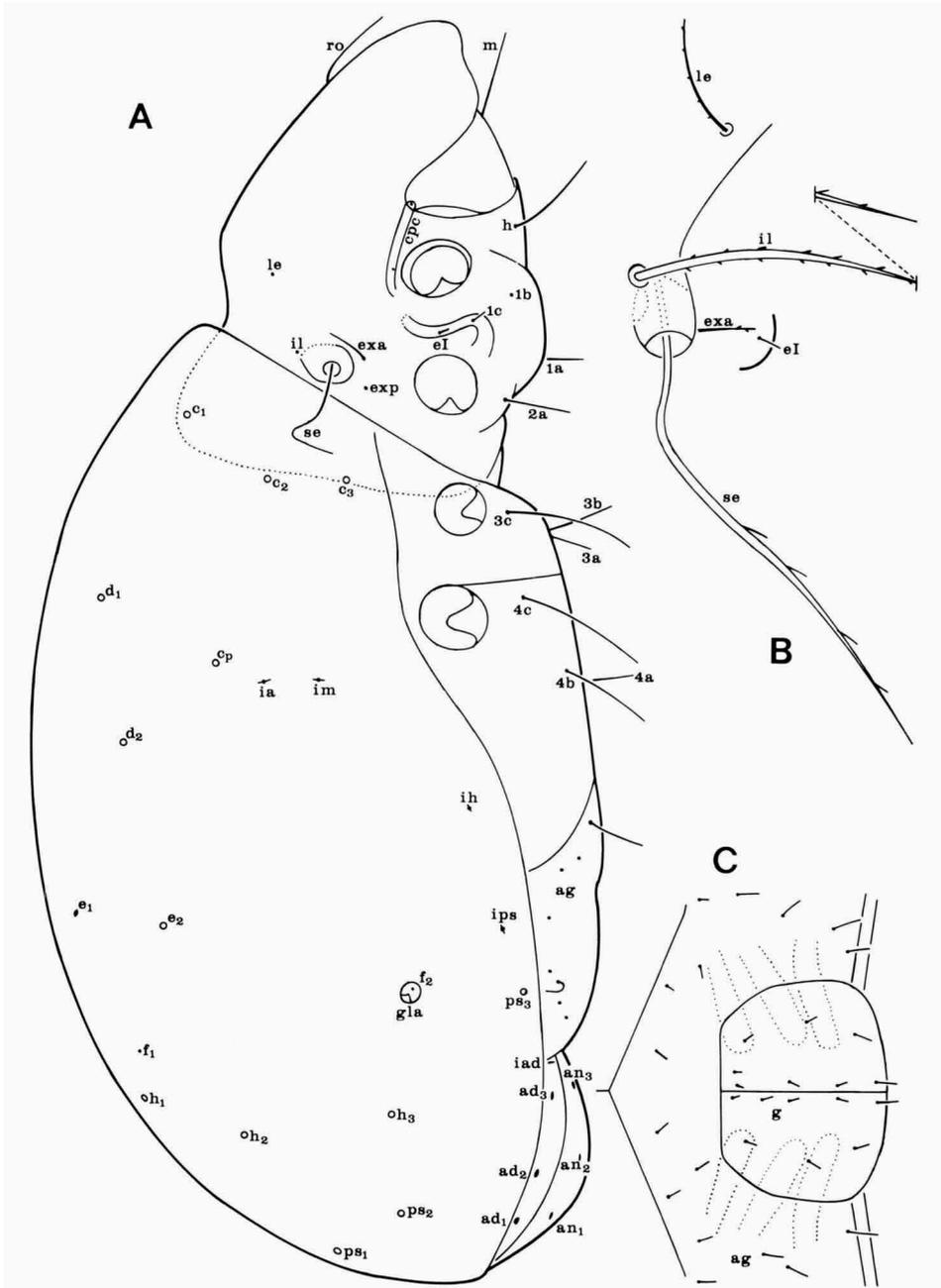


Fig. 2. *Epilohmannia zwarti* spec. nov.; A, lateral view of exoskeleton of adult female; B, dorsal view of right bothridium, sensillus, lamellar seta, exobothridial seta and supracoxal seta *el* of adult male; C, ventral view of genital and aggenital region of adult female; A, C, $\times 200$; B, $\times 404$.

with its limbus (fig. 3D, E); a naso with an inferior convexity is present at the ventral surface of the rostral base. The rostral setae are rather small and thin, with a few minute ciliae (as in the other setae); their position is more or less variable, but one of the paired setae (the left in both figured specimens) is generally more advanced than the other. The lamellar, interlamellar, bothridial and anterior exobothridial setae (and the supracoxal seta *eI*) are also represented separately in fig. 2B; in all specimens investigated by me, the posterior exobothridial seta (fig. 2A) was reduced to its alveolus. The lamellar setae are relatively short and thin. The interlamellar setae are inserted close to the bothridium; they are long (much more than half as long as their mutual distance). The sensillus is setiform and ciliated. The anterior exobothridial seta is small.

Notogaster. — The notogastral setae (fig. 1A, B) are generally very long, and several of them (c_1 , c_p , e_1 , e_2 , h_1 , h_2) surpass the place of insertion of the seta immediately posterior to them. Notogastral setae c_3 , h_3 , and ps_3 , however, are much shorter. All notogastral setae are slightly ciliated. Setae f_1 and f_2 are vestigial; f_2 (fig. 2A) is close to the orifice of the latero-opisthosomatic gland. (The problem of the homology of the notogastral setae and lyrifissures in the family Epilohmanniidae was recently solved by Norton, Metz & Sharma, 1978.) Notogastral lyrifissures are best visible in lateral view (fig. 2A; this figure was prepared after an exoskeleton in which setal bases, lyrifissures and glands are easier observable than in the dark specimens which have preserved their internal organs); *ia* and *im* are more or less ventral to c_p ; *ips* and *ih* are anterior to ps_3 . The position of the orifice of the latero-opisthosomatic gland is anterior to h_3 and dorsal to ps_3 .

Ano-adanal region (fig. 1B). — The anal opening is relatively large and occupies a postero-ventral position. There are three anal setae (an_{1-3}) and an anal lyrifissure *ian* (with more or less longitudinal orientation). There are also three adanal setae (ad_{1-3}) and an adanal lyrifissure *iad* (with more or less transverse orientation).

Genito-aggenital region (fig. 1B). — The genito-aggenital region is separated from the ano-adanal region by a transverse scissure, an interruption of the sclerotized cuticle, in the shape of a narrow band of soft skin (this type of ventral scissure is referred to as schizogastric). There are eight genital setae, arranged in two rows: one row of five setae near the paraxial border, and a row of three setae with a more anti-axial position. The adults present the normal number of three genital papillae. The female genital opening (fig. 2C) is relatively larger, but presents the same number of setae. The aggenital region is neotrichous; in my specimens, there are seven or eight aggenital setae with slightly asymmetrical and irregular positions.

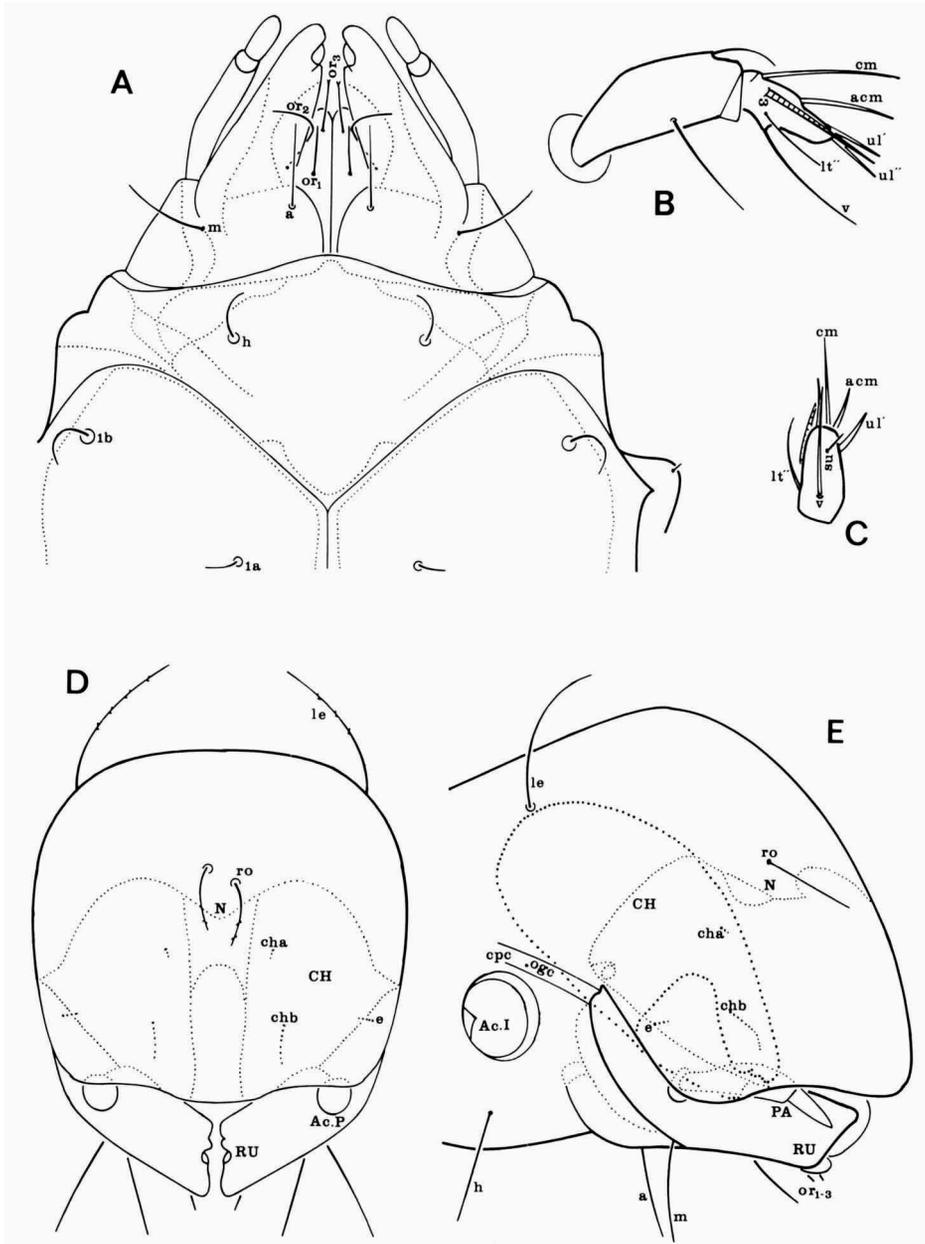


Fig. 3. *Epilohmannia zwarti* spec. nov., adult male; A, ventral view of anterior part of prosoma (infracapitulum and epimera 1); B, lateral (antiaxial) view of right palp; C, ventral view of right palpal tarsus; D, frontal view of anterior part of prosoma; E, lateral (oblique) view of anterior part of prosoma (the rostral part is at the same level as acetabulum I); A, $\times 376$; B, C, $\times 550$; D, E, $\times 295$.

Ventral aspect of podosoma (fig. 1B). — The podosoma is characterized by the presence of a protero-hysterosomatic articulation (dichoidy) at the place of the ventro-sejugal interval. The epimera are separated and bordered by apodemes; there is also a sternal apodeme in the sagittal plane, internally separating the apodemes of the left and right side. Epimera 1 are separated from the infracapitulum by apodemes 1 (there is no gnatho-idiosomatic articulation and no mentotectum); epimera 4, which are relatively very large, are separated from the aggenital region by apodemes 4. The formula of the epimeral setae is 3-1-3-3.

Lateral aspect of podosoma (fig. 2A). — There is a rounded projection between the acetabula of legs I and II; it bears the supracoxal seta *eI* and epimeral seta *lc*. The idiosomatic part of the podocephalic canal extends from above the base of leg I to the base of the rostral tectum. The orifice of the coxal gland is above the base of leg I. Another podocephalic orifice (homologous with the orifice *og*₁ of the anterior podocephalic gland in *Hermannia convexa* (C.L. Koch); see Van der Hammen, 1968: 19-22, fig. 11) is present near the base of the rostral tectum. There is probably also an orifice of a median podocephalic gland (homologous with *og*₂ in *Hermannia*), although it could not be discerned with absolute certainty.

Infracapitulum. — The infracapitulum is represented, in ventral view, in fig. 3A. As mentioned above, the mentum has fused with epimera 1 (apodemes 1 are, however, present), and there is no mentotectum. The infracapitulum is diarthrous and the transverse labiogenal articulation is well-developed, presenting a distinct tectum; the mentum is relatively large, but the genae are much smaller. Part of the rôle of the gnatho-idiosomatic articulation is apparently taken over by the labiogenal articulation. There are three pairs of infracapitular setae (*h*, *m*, *a*). The rutellum is atelebasic and its separation from the genae is apparently incomplete. There are three pairs of adoral setae (*or*₁₋₃); *or*₃ is bifurcate in the terminal part.

Chelicera. — The chelicera (fig. 3D, E) is relatively large, with robust jaws. Cheliceral seta *cha* is small; *chb* is much longer.

Palp (fig. 3B, C). — As a result of fusion, the palp consists of two segments. The basal segment represents trochanter, femur, genu and tibia; it bears two setae: a dorsal and an antilateroventral. The tarsus presents a solenidion and seven setae (*cm*, *acm*, *ul'*, *ul''*, *su*, *lt''* and *v*; *ul'* and *ul''* are eupathidic).

Legs (figs. 4, 5). — The legs consist of six segments: trochanter, femur, genu, tibia, tarsus and apotele. The femur of legs I and II is exceptionally small, the genu much larger. All legs are monodactyl. The numbers of solenidia on genu, tibia and tarsus of legs I-IV are the following: I (2-1-3); II (1-1-2); III (1-1-0); IV

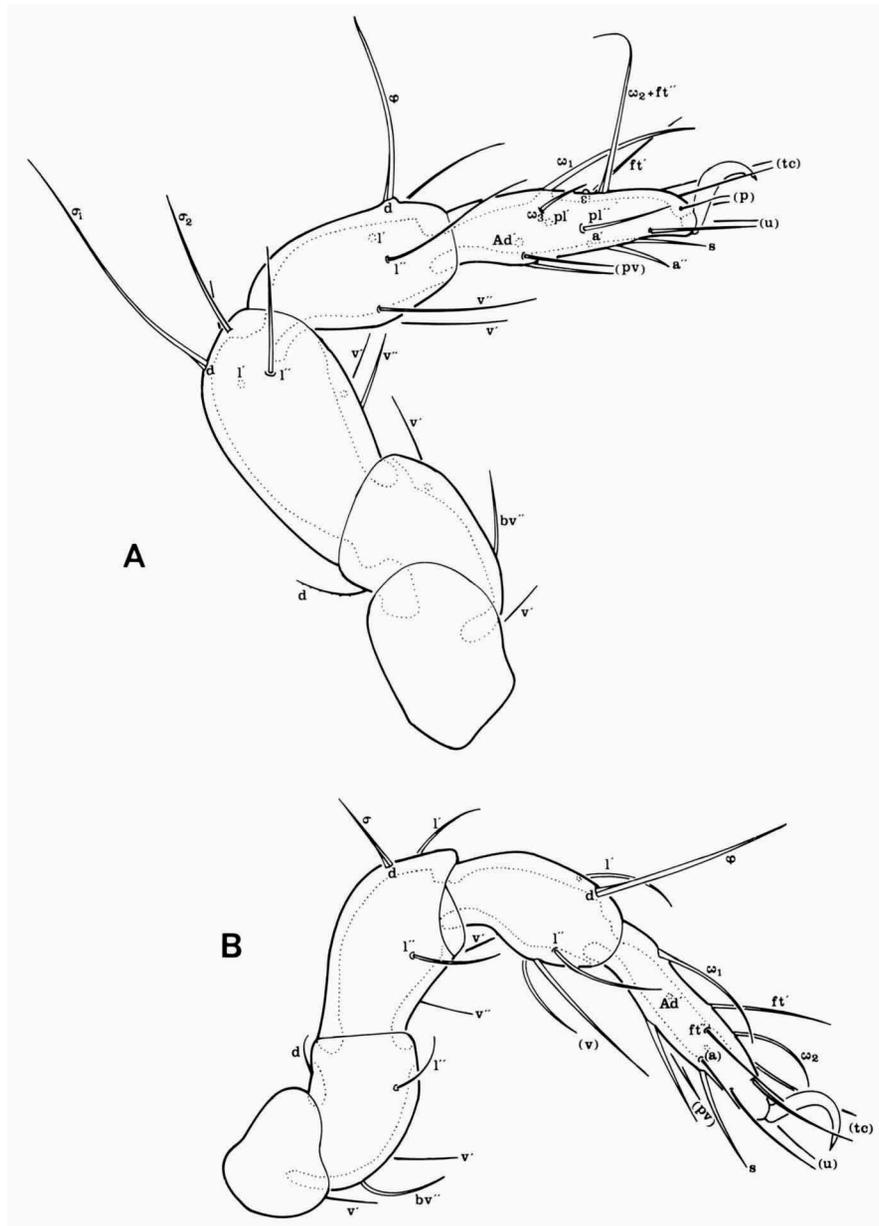


Fig. 4. *Epilohmannia zwarti* spec. nov., adult male; A, right leg I, lateral (antiaxial = posterior) view; B, right leg II, lateral (antiaxial = posterior) view; A, B, $\times 295$.

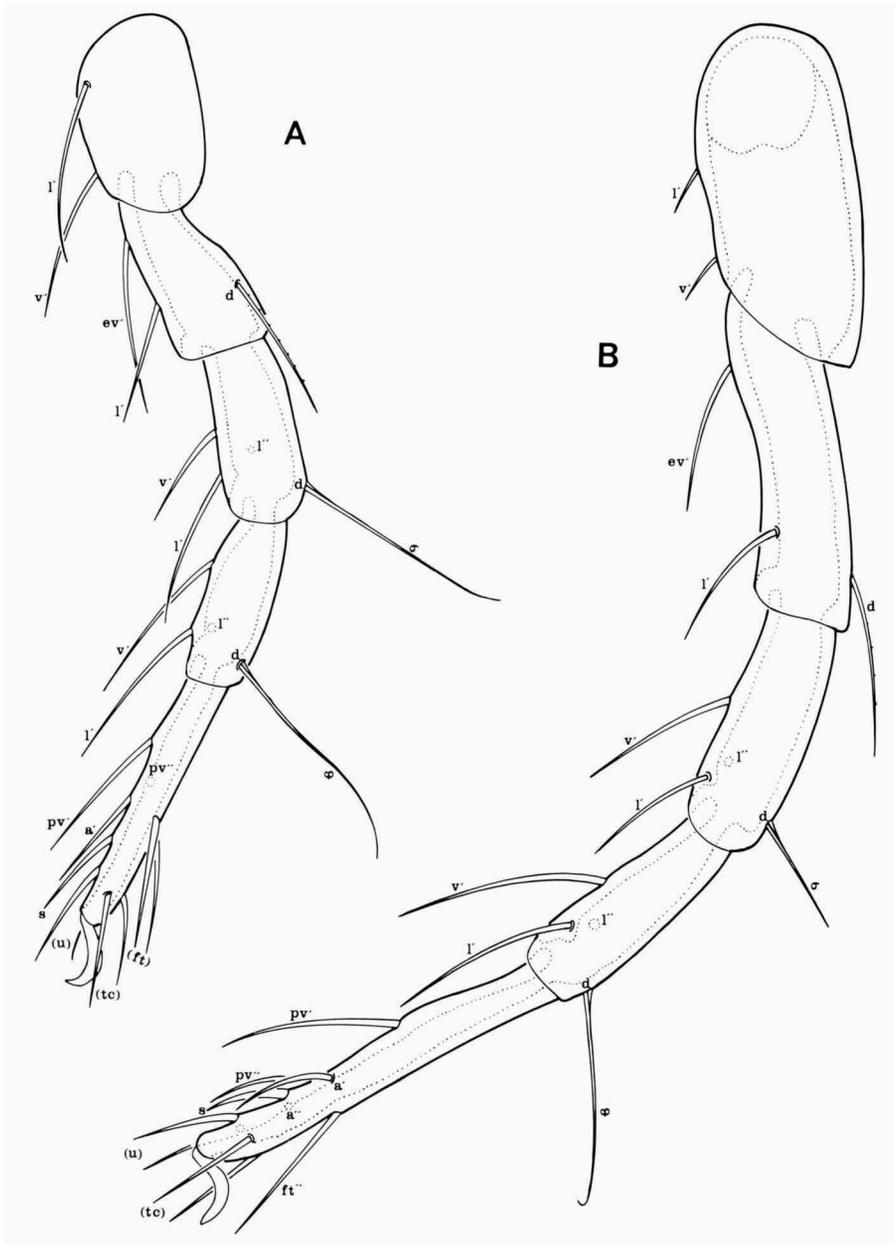


Fig. 5. *Epilohmannia zwarti* spec. nov., adult male; A, left leg III, lateral (antiaxial = anterior) view; B, left leg IV, lateral (antiaxial = anterior) view; A, B, $\times 295$.

(1-1-0). On tarsus I, the famulus is reduced to a small, rounded projection. The solenidia of genu (one of the two in the case of genu I) and tibia of legs I-IV are coupled with the dorsal seta *d*, which is very small; the true size of seta *d* can only be discerned after extraction of the solenidion. The second solenidion of the tarsus is coupled with seta *ft''*. The formulae of the setae on trochanter, femur, genu, tibia and tarsus of legs I-IV are the following: I (1-3-5-5-17); II (1-4-5-5-12); III (2-3-4-4-10); IV (2-3-4-4-9). Seta *s* of tarsus IV is the only thickened spiniform seta (it is thickened in both sexes).

RELATIONSHIPS

Up to now twenty-five species of the genus *Epilohmannia* Berlese have been described, all from the warmer regions of the world. The descriptions of several of these species are, however, incomplete; many important characters, such as the microsculpture of epimeron 2, the exact position of the latero-opisthosomatic gland, and the chaetotaxy of the legs, are known from a few species only. The reticulate microsculpture of epimeron 2, for instance, described here for *E. zwarti*, is also mentioned for *E. multisetosa* Hammer and *E. sculpturata* Balogh & Mahunka (1980: 24, fig. 2C), but could be a general character of the genus *Epilohmannia* or the family Epilohmanniidae. Among the more detailed descriptions, mention must be made of those published by Wallwork (1962). An important study of the related genus *Epilohmannoides* Jacot was published by Norton, Metz & Sharma (1978). A key to the species of *Epilohmannia* was recently published by Pérez-Iñigo & Baggio (1985: 186-188). Unfortunately, the first choice in this key is between eight or more pairs of aggenital setae, on the one hand, and seven or less pairs, on the other (in *E. zwarti* the number of aggenital setae is seven or eight pairs). As a result of a first choice of eight pairs of aggenital setae, the species keys out as *E. multisetosa* Hammer (1971: 6-7, fig. 3) from the Fiji Islands. In the case of the second choice (seven pairs of aggenital setae) the key brings us to a dead-lock. *E. zwarti* belongs to the group of relatively large, rather dark species with setiform sensillus; it is characterized, among others, by the position of the latero-opisthosomatic gland (above *ps*₃) and the presence of the lyrifissures *ih* and *ips*. It is indeed most closely related to *E. multisetosa* (the interlamellar setae are inserted close to the bothridium, and are longer than the lamellar setae; the notogastral setae are rather long; the aggenital neotrichy is in an advanced stage; the microsculpture of epimera 2 is reticulate; the only thickened seta of the legs is seta *s* of tarsus IV). The following important differences are pointed out. *E. multisetosa* is lighter in

colour and smaller than *E. zwarti*, and it is relatively much broader (ratio length: breadth 1.57 in *multisetosa*, 1.82-1.83 in *zwarti*); the notogastral and particularly the interlamellar setae are shorter, the ridges of the reticulate microsculpture of epimera 2 are much higher (at the lateral border), the position of epimeral seta *4b* is more posterolateral, and the aggenital neotrichy is still more advanced (up to a total of twenty setae).

COMPARATIVE STUDY OF THE MOUTHPARTS OF EPILOHMANNIIDAE AND PALPIGRADI

As mentioned in the introduction, the present study was partly made in order to enable a comparison of the mouthparts of *Epilohmannia* and Palpigradi; in both taxa, the epimera of the segments of palp and leg I have fused.

Palpigradi (see Van der Hammen, 1982) are characterized by the presence of very simple mouthparts, comprising chelicerae, labrum and labium; the last-mentioned two elements have fused in the basal part. The long palpigrade palp has an ambulatory function (leg I can function as a "feeler"), but the insertion of extensor muscles (see Van der Hammen, 1982: fig. 5B) on the base of the tibia (as in leg I) suggests that it can also function as a "feeler". The epimera of palp and leg I constitute a single sclerite (see Van der Hammen, 1982: figs. 2A, 4B); the segmental border is indicated by muscle insertions, and the segments by the epimeral chaetotaxy. The fusion of the epimera is probably of secondary origin, and could be associated with the ambulatory function of the palp or with the sensory function of both palp and leg I; the last-mentioned possibility is more probable because the fusion suggests an association of functions.

The mouthparts of *Epilohmannia* are constituted by a gnathosoma of which the mentum (the epimera of the palpal segment) have secondarily fused with the epimera of the segment of leg I. In the species described above (and apparently also in the other species of the genus), the infracapitulum is diarthrous, and the labiogenal articulation (characterized by the presence of a tectum) has apparently taken over part of the function of the gnatho-idiosomatic articulation. In the related genus *Epilohmannoides* (see Norton, Metz & Sharma, 1978: 135-138, 144, 145, fig. 1G), the infracapitulum is stenarthrous and the epimera of the segments of palp and leg I have either fused or are connected by an articulation. In all Oribated mites, the palp is very small and has a sensory function only; in Epilohmanniidae, the proximal segments of the palp (trochanter, femur, genu, tibia) have, moreover, fused. The fusion of the

epimera of the segments of palp and leg I, in Epilohmanniidae, constitutes an isolated phenomenon, and must be associated with some aspects of ingestion, of which the nature is, as yet, unknown.

The differences between the simple mouthparts of Palpigradi and the specialized gnathosoma of *Epilohmannia* are considerable. For the present comparison it is of particular interest that the long palpigrade palp (limb 2) has an ambulatory function, whilst the function of the reduced actinotrichid palp is sensory. The fusion of the epimera of the segments of palp and leg I, in the two groups, must be associated with completely different adaptations. The hypothesis could be introduced that the palpigrade mouthparts represent a regressive gnathosoma, but there is no evidence to support it. An important element in the comparison of the palpigrade and actinotrichid mouthparts is constituted by the uncertain homology of the labium. A chelicerate labium is generally homologized with the sternite of the palpal segment (sternite 2), but that of the Palpigradi (situated anterior to sternite 2) was supposed to be homologous with the sternite of the cheliceral segment (see Millot, 1949: 521). In Actinotrichida, a labium is present in primitive species only; it is no more present (or no more recognizable) in Epilohmanniidae. It could be homologous with the labium in Palpigradi, and that in Solifugae and Pseudoscorpionida, which groups are now supposed to be distantly related to Palpigradi and Actinotrichida (see Van der Hammen, 1986). A comparative study of the morphogenesis of the labium in the four groups (Palpigradi, primitive Actinotrichida, Solifugae and Pseudoscorpionida) could be clarifying.

LIST OF NOTATIONS

- a*, anterior infracapitular seta.
- (a)*, *a'*, *a''*, antelateral setae of tarsus.
- acm*, anteroculminal seta of palpal tarsus.
- Ac.P*, acetabulum of palp.
- Ac.I*, acetabulum of leg I.
- Ad'*, anterolateral accessory seta of tarsus.
- ad*₁₋₃, adanal setae.
- ag*, aggenital setae.
- an*₁₋₃, anal setae.

- bv''*, basiventral seta of femur I-II.

c_{1-3} , c_p , notogastral setae attributed to segments VII-VIII.

CH, chelicera.

cha, *chb*, setae of chelicera.

cm, culminal seta of palp.

cpc, podocephalic canal.

d, dorsal seta of legs.

d_{1-2} , notogastral setae attributed to segment IX.

e, supracoxal seta of palp.

e_{1-2} , notogastral setae attributed to segment X.

ev', basiventral seta of femur III and IV.

exa, anterior exobothridial seta.

exp, posterior exobothridial seta.

eI, supracoxal seta of leg I.

f_{1-2} , notogastral setae attributed to segment XI.

ft', *ft''*, fastigial setae of tarsus.

g, genital setae.

gla, latero-opisthosomatic gland.

h, seta of mentum.

h_{1-3} , notogastral setae attributed to segment XII.

ia, anterior opisthosomatic lyrifissure.

iad, adanal lyrifissure.

ian, anal lyrifissure.

ih, opisthosomatic lyrifissure attributed to segment XII.

il, interlamellar seta.

im, median opisthosomatic lyrifissure.

ips, opisthosomatic lyrifissure of pseudanal segment.

l', *l''*, lateral setae.

le, lamellar seta.

lt'', posterolateral seta of palp.

m, median infracapitular seta.

N, naso.

*or*₁₋₃, adoral setae.

(*p*), proral setae of tarsus.

PA, palp.

pl', *pl''*, primilateral setae of tarsus.

*ps*₁₋₃, pseudanal setae.

(*pv*), *pv'*, *pv''*, primiventral setae of tarsus.

ro, rostral seta.

RU, rutellum.

s, subunguinal seta of tarsus.

se, sensillus.

su, subultimate seta of palpal tarsus.

(*tc*), tectal setae of tarsus.

(*u*), unguinal setae of tarsus.

ul', *ul''*, ultimate setae of palpal tarsus.

(*v*), *v'*, *v''*, ventral setae of legs and palp.

1a-c, setae of epimeron 1.

2a, seta of epimeron 2.

3a-c, setae of epimeron 3.

4a-c, setae of epimeron 4.

ε (epsilon), famulus.

σ, σ₁, σ₂ (sigma), solenidia of genu.

φ (phi), solenidium of tibia.

ω (omega), solenidium of tarsus.

' (prime), anterior face of an appendage.

'' (double prime), posterior face of an appendage.

() (brackets), a pair.

REFERENCES

- Balogh, J. & S. Mahunka, 1980. New data to the knowledge of the Oribatid fauna of the Neogea (Acari). V. — Act. Zool. Acad. Sci. Hung. 26: 21-59, figs. 1-22.
- Hammen, L. van der, 1968. The gnathosoma of *Hermannia convexa* (C.L. Koch) (Acarida: Oribatina) and comparative remarks on its morphology in other mites. — Zool. Verh. Leiden 94: 1-45, figs. 1-12.
- Hammen, L. van der, 1982. Comparative studies in Chelicerata II. Epimerata (Palpigradi and Actinotrichida). — Zool. Verh. Leiden 196: 1-70, figs. 1-31.
- Hammen, L. van der, 1983. Contribution to the knowledge of the soil-fauna of New Guinea. — Zool. Verh. Leiden 206: 1-36, text-figs. 1-5, pls. 1-19.
- Hammen, L. van der, 1985. Comparative studies in Chelicerata III. Opiliona. — Zool. Verh. Leiden 220: 1-60, figs. 1-34.
- Hammen, L. van der, 1986. Comparative studies in Chelicerata IV. Apatellata, Arachnida, Scorpionida, Xiphosura. — Zool. Verh. Leiden, 226: 1-52, figs. 1-23.
- Hammer, M., 1971. On some Oribatids from Viti Levu, the Fiji Islands. — Biol. Skr. Kong. Dansk. Vidensk. Selsk. 16 (6): 1-60, pls. 1-25.
- Millot, J., 1949. Ordre des Palpigrades. Palpigradi, Thorell, 1800 [read: 1888]. Microtelyphonida, Grassi et Calandruccio, 1885. — In: P.-P. Grassé, Traité de Zoologie. Anatomie, systématique, biologie 6: 520-532, figs. 274-286.
- Norton, R.A., L.J. Metz & G.D. Sharma, 1978. Observations on *Epilohmannoides* Jacot, 1936 (Acarina: Oribatei), with the description of a new species. — Journ. Georgia Entomol. Soc. 13: 134-148, figs. 1-4.
- Pérez-Iñigo, C. & D. Baggio, 1985. Oribates édaphiques du Brésil (II). Oribates de l'île du "Cardoso" (Première Partie). — Acarologia 26: 183-199, figs. 1-20.
- Wallwork, J.A., 1962. Some Oribatei from Ghana XI. The genus *Epilohmannia* Berlese 1916. — Acarologia 4: 671-693, figs. 1-31.